



# COBRA 2010

## The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors

## Held at Dauphine Université, Paris, 2-3 September 2010

ISBN 978-1-84219-619-9



12 Great George Street
London SW1P 3AD
United Kingdom

www.rics.org/cobra

September 2010

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All papers submitted to COBRA were subjected to a double-blind (peer review) refereeing process. Referees were drawn from an expert panel, representing respected academics from the construction and building research community. The conference organisers wish to extend their appreciation to the following members of the panel for their work, which is invaluable to the success of COBRA.

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# Capacity building of disaster waste management for disaster risk reduction

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## Abstract

Natural hazards are extreme events that could cause harm on both socio-economic and ecological systems which ultimately become major disasters. Therefore, identification of vulnerabilities and risks of major hazards are important for any country. Sri Lanka is also in the process of developing a risk profile of natural hazards after the Asian Tsunami of 2004. In this context, various national and local level workshops have been conducted for capacity building of non structural measures for disaster risk reduction. On this, this paper highlights a natural hazard: disaster waste which has high impact on disaster risk reduction, but given less attention in Sri Lanka where its creation and impact is unavoidable. Specially, absence of proper disaster waste management strategies eventually put health and safety of victims at a risk. Further, in the long term it affects increased frequency of disasters in spite of smaller impacts, such as floods. Thus, this paper highlights capacity gaps identified in post disaster waste management and its impact on disaster risk reduction. Semi structured interviews was conducted to collect data from stakeholders involved in disaster waste management at national and local levels. Unavailability of single point responsibility, statutorily enforceable rules and regulations and capacity constraints are identified as gaps in disaster waste management. Enhancement of administrative and operational level capacities of national agencies, specifically by granting legal powers and increasing awareness among the society will enable overcoming of above gaps.

**Key words:** Capacity building, Disaster waste, Risk reduction

## 1 Introduction

Impacts of disasters, whether natural or man made, have not only human but environmental dimensions as well. Casualties including deaths, injured and misplaced people are major physical impacts of any kind of a disaster while property damages, collapsing buildings, infrastructure and crop destruction are some critical matters which impact with environmental dimensions (Shaw, 2006). Among these, generation of disaster waste resulting from collapsing buildings and infrastructure is unavoidable which cause serious environmental and economical burden on normal living conditions, reconstruction and general municipal waste collection processes (UNEP, 2005). Specifically, waste disposal has emerged as a critical issue in responding to a disaster in any country. Further, disasters are so closely intertwined with environment that proper environmental management and governance is essential for long term peace, stability and security in disaster prone countries particularly, in developing countries where affected communities rely heavily on natural resources for survival. Impacts on health and safety of victims in absence of proper waste management strategies and approaches increase risks.

Risk is an equally unavoidable component associated with any activity which plays a huge role in the present world (Wang and Chou, 2003). Disaster risk is a measure of expected losses due to a hazard event occurring in a given area over a specific period (Khan *et al,* 2007). Thus, there is a need to adapt specific strategies to reduce disaster risk and effectively manage disasters. These problems are equally applicable in Sri Lanka which is prone to frequent natural disasters. United Nations Environment Protection Report (2005) stated that debris generated by the Asian Tsunami in 2004 was not properly disposed, reused or managed. This paper aims to explore capacities of post disaster waste management, challenges faced and its impacts on disaster risk reduction. Forthcoming sections of the paper discuss disaster risk in the contexts of disaster waste management, field survey findings and proposed model for the study.

## 2 Disaster risk reduction

Risk means the probability of a particular hazardous event or condition occurring and the losses it would cause (McEntire, 2005). Mainly it would depend upon the nature of the hazard, vulnerability and economic value of affected elements (Khan *et al,* 2007). El-Sayegh (2008) argued that risk is more than economical or physical loss due to immeasurable uncertainty. Thus, strategies towards disaster risk reduction play a key role. According to Mitchell (2006) disaster risk reduction referred to reduction or prevention of suffering and strain of disasters on people and things they value and to

promote safety and sustainable development in communities all over the world. Bien *et al* (2006) further indicated it as a shared objective promoting resilience offering opportunities for more holistic and proactive responses. Accordingly, it can be defined as taking measures in advance, addressing risk reduction, involving environmental protection, social equity and economic growth.

Gopalakrishnan (2007) introduced three fundamental aspects of disaster risk reduction as disaster response, preparedness and mitigation which corresponds with two phases in the disaster cycle, risk reduction (before) and recovery (after) phase. Khan *et al* (2008), further enhance it into three stages as before, during and after a disaster with purposes to avoid, reduce or recover from its losses. International Strategy for Disaster Reduction (2008) introduced strategies for reducing disaster risks through a plan of five priorities:

- Ensure disaster risk reduction as a national and a local priority with a strong institutional basis for implementation.
- Identify, assess and monitor disaster risks and enhance early warning.
- Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
- Reduce underlying risk factors.
- Strengthen disaster preparedness for effective response.

Further, it emphasises on implementing the profile consistent with aforesaid priorities in the country in a more systematic and consistent effort to support national disaster reduction efforts (ISDR, 2008).

### *2.1 Disaster risk reduction in Sri Lanka*

Sri Lanka has become prone to disasters, both natural and manmade with increasing losses to life and property during the recent decades. Natural disasters in Sri Lanka are commonly caused by floods, cyclones, landslides, droughts and coastal erosion (Jayawardane, 2006). With the impact of Asian Tsunami in 2004, major disaster risk reduction strategies are designed in Sri Lanka for implementation. The planned risk profile is intended to address major natural disasters and Disaster Management Centre (DMC) is to play the key role. Main objective of this profile is to provide decision makers and planers credible information on locations, frequency and impacts of main hazards as well as information on vulnerable elements at risk. With this knowledge, policies and strategies can be formulated, mitigation, preparedness and contingency plans can be developed and risk reduction elements can be factored into development projects. Five national level institutes are involved in preparing disaster risk profile in respect of each hazard type illustrated at table 1.

**Table 1: Institutes Involved in Preparing Disaster Risk Profiles.**

| Hazards & tasks | Institute |
|---|---|
| Project coordination, logistics, monitoring, evaluation and technical support | Disaster Management Centre (DMC) |
| Landslide hazards and risk mapping | National Building Research Organization |
| Coastal hazards and risk mapping | Coastal Conservation Department |
| Flood hazards and risk mapping | Department of Irrigation |
| Drought hazards and risk mapping | Department of Agriculture, University of Peradeniya |
| Cyclone hazards and risk mapping | Department of Meteorology |

A disaster risk profile consists of two phases as developing hazard maps and developing risk maps. At the end DMC expects to achieve following outputs:

- Rationale for development of a hazard and risk atlas.
- Description of methodology and definition of key terms.
- Hazard and risk maps that depict physical vulnerability of Districts, DS Divisions and GN Divisions to specific hazards coupled with a brief description of frequency of occurrence and impacts that it has had on mortality in the past.
- An overlay on hazard areas of vulnerable elements at risk capturing physical, social, economic and environmental vulnerability.
- An analysis of vulnerability, coping capacity of society and recommendations.

### *2.2 Disaster waste & its impacts on disaster risk reduction*

In a disaster, generation of waste is unavoidable. Generally, waste is defined as any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of a client (Formoso *et al*, 1999) or any substance or object which the holder intends or is required to discard. Peterson (2004) indicated that disaster waste become critical as it differs from the normal situation which generates waste in a more or less stable quantities and composition whereas in a post disaster, it radically changes in type and quantity. Specifically, disaster waste may contain or be contaminated with certain toxic or hazardous constituents. Srinivas and Nakagawa (2007) indicated that disaster debris as the most critical environmental problem faced by countries affected by the Asian Tsunami in 2004. Further, General Accounting Office Report on *Hurricane*

*Katrina: Continuing debris removal and disposal issues* also highlighted that how failures in disaster debris management continue to impact on environmental health of citizens at the end of three years (GAO 2008). Rapid Environment Impact Assessment conducted on Haiti Earthquake also highlighted importance of proper debris management to avoid damage to environment, livelihoods and recovery efforts (Kelly, 2010). In addition, many had highlighted the importance of focusing on long term ecologically and economically sustainable debris management strategies for a resilient future (Lauritzen, 1998; Baycan and Petersen, 2002; Blakely, 2007). Specifically, it is essential for long term peace, stability and security in disaster prone countries particularly, in developing countries where affected communities rely heavily on natural resources for survival (Karunasena *et al,* 2009). Thus, it is important to maximize environmentally sustainable values while minimizing disaster waste generation and impact.

In Sri Lanka, risk assessments conducted in recent past indicated that most disaster waste management programs conducted at local levels with collaboration of NGOs do not consistently meet current best practices due to lack of readily available guidance, practical procedures and resources (UNDP, 2005;UNEP 2005). Paper titled "Utilization of Tsunami debris for reconstruction process in Sri Lanka" by Gunawardena and Rajakaruna (2005), pointed out inadequate education material on how to recycle Tsunami debris, lack of awareness and training for technical people on standards and reuse of materials, poor waste management plans, legislations related to scope and lack of appropriate monitoring systems, minimal legislation related to landfill activities and standards, lack of experience on debris recycling, insufficient economic incentives for recyclers and high initial costs as key challenges in disaster waste management. Further, there is no proper garbage discharge in Sri Lanka and many drains are blocked, causing health problem such as dengue (Perera, 2003). Thus, economical and environmentally sound waste management programmes are essential not only for disaster waste but also for municipal solid waste management in Sri Lanka.

## 3 Research methodology

Literature review and documentary survey was conducted on risk reduction and waste management in post disaster management. Pilot interviews were conducted at both national and local levels including both government and non government organisations involved in disaster waste management in Sri Lanka. A detail profile of pilot interviews is illustrated at table 2.

**Table 2: Profile of Pilot Interviews**

| Organisation | Type | Number of interviews |
|---|---|---|
| Disaster Management Centre (National) | Gov. | 1 |
| Sarvodaya Shramadana Movement (National) | Non-Gov. | 1 |
| Sri Lanka Operations Centre (Local) | Gov. | 1 |
| Galle Municipal Council (Local) | Gov. | 1 |

One each government and non governmental organisations were selected at national levels and two government organisations were selected at local level. One interviewee from each was selected from top or middle management involved in post disaster management processes having experience in waste management. Semi-structured interviews were conducted to gather data as it facilitated in depth analysis and gather different views and opinions of respondents within scope of the study.

Content analysis was used in order to analyze collected data. Nvivo software was used for easier and speedy content analysis. Relevant coding structures were prepared using software and analysed in order to determine existing capacities. Coding structure prepared mainly focuses on existing capacities as illustrated at figure 1.


**Figure 1: Coding Structure**

## 4 Pilot interviews' findings

### *4.1 Capacities of disaster waste management – national*

National level government institutes such as DMC, are mostly involved in policy making, resource allocation, prioritization of activities, budget allocation and monitoring of disaster management plans whereas all other related activities are delegated to local levels (Refer Sri Lanka Disaster Management

Act, No.13 of 2005). Non government institutes such as Sarvodaya provide knowledge and valuable ideas to the government sector which they gain through practical experience.

Further, findings revealed that in large scale disasters, waste were managed with the collaboration of national and local level organisations. Roles and functions of an organisation in disaster waste management varied based on the type of a disaster. As a result, organisations not owing any responsibility over disaster waste made contributions at massive disasters in their own specialized areas. For example, while one organisation cleaned roads, another cleared debris from the sea shore. Moreover, some organisations provided equipment and technical knowledge whereas some other organisations gave financial assistance.

Most national level government institutes focus more on administrative level activities whereas non government organizations focus on operational level activities. A significance fact is that government institutes don't identify their capacities to guide others on assigning tasks and gain active participation. Further, most non government institutes do not highlight these facts due to political influences, bureaucracy, de-motivation and time consuming processes. All interviewees revealed that community unawareness has a major influence on proper disaster management. In addition, inadequate legal powers and lack of operational powers are identified as major capacity gaps at national level. This is differentiated in point of view of non government organisations which only have a social responsibility or public interest.

Therefore, issues of non government organisations highly deviate from issues of government organisations. In case of workforce and physical assets, government organisations lack capacities whereas non government organisations such as Sarvodaya possess a 75,000 volunteer base and physical resources. However, most of these resources idle as there are fewer opportunities to involve in large scale disaster management activities. As a result change of attitudes of government institutes should be encouraged in getting maximum utility from in-house NGOs by sharing responsibilities, assigning considerable amount of liabilities and getting active commitment.

### *4.2 Capacities of disaster waste management – local*

Pilot interviews revealed that capacities at local levels are different from each district. Galle district is in sufficient capacity levels in terms of finance, technology, physical assets, management and legal powers. Specifically, government organizations in Galle district have sufficient facilitation from professionals and NGOs which give support to handle post disaster waste successfully, by introducing

new technology on waste handling, conducting workshops, research studies and financial assistance. For an example the COWAM (Construction Waste Management) project within the EU-ASIA PRO ECO II B Post Tsunami Programme was initiated to manage C&D waste in Sri Lanka. The Galle Municipal Council was selected as the beneficiary, since the area was highly built up and suffered devastation. The aim was to provide Galle area with practical solutions for implementing a sustainable C&D waste management programme and for it to become a model for all other local authorities in the country. This involves preparation of guides for public on waste management, control illegal dumping, give legal support, select suitable places for gathering waste, supply human and physical resources, implement rules and regulations and reduce use of virgin construction material. In addition, research on waste management, testing construction and recycled materials and sharing knowledge of professionals are also identified achievements of this project.

Organizations in Ampara district such as Sri Lanka Operations Centre are running with sufficient capacity. Government organizations function with financial capacity aided by donations, technologies and physical assets of NGOs. Further, training and awareness programmes are conducted to retain and enhance skills of government organisations to maintain existing capacities. For an example, in Amapara few waste management projects were initiated after the Asia Tsunami in 2004 targeting recycling of plastic items and composting of degradable components (Van der Wel and Post, 2007).

Most common issues are unawareness among community, lack of technology, physical assets and finance. This is further aggravated due to absence of pre-plans, less coordination among organizations, less innovation of technology and improper post disaster waste management mechanisms. The lack of authority to function is another common issue which impact bottom level government organizations as they have not been given enough power to initiate or implement any work without coordinating with top level departments. Other than these, lacks of professionals, lack of coordination among service providers, less research, unavailability of long term plans and frail rules and regulations affect each organisation. This is mainly impacted by improper guidance of national level organizations and absence of local frameworks for post disaster waste management. Though general solid waste management rules and regulations prevail in Sri Lanka, they are not properly implemented due to absence of penalties or incentives.

Accordingly, findings revealed that capacity of post disaster waste management exist with certain gaps which need to be addressed. Further, findings established most capacity requirements relate with functions of national level agencies involved with disaster waste management such as planning, coordinating and implementing statutorily enforceable legislation, resource allocation, budget allocation etc.

## 5 Discussion

Proposed approaches for capacity building for disaster waste management are based on various assumptions extracted from other sectors such as health and public administration identified through secondary data. Further, proposed approaches are refined in line with pilot interviews' findings.

- Skills and confidence building

It focuses on human resources: education and training to improve ability to perform functions. In addition, it attracts public for jobs and retention of individuals as they pursue such careers. This dimension focuses particularly on managerial and technical levels to extend their overall performance of a given task. In addition, development of policies and position statements supporting concepts of career progression and opportunities to apply skills development are also important to build confidence.

- Organizational implementation

This focuses on improving organization structures and processes related with waste management. This involves establishing goals, hierarchy for waste management and formal and informal communication within organization. Further, emphasis is on existing capacities on assessment of types of waste generation, risk involvement, identification of cost effective material, monitoring and evaluation methods, incentives to people involved and rules and regulations on post disaster waste management.

- Linkages and collaborations

Third focuses on building partnerships and collaborations as a means of building capacities by mechanisms which exchange skills and practice knowledge. The linkages that exist for waste management includes universities and practices, experienced researchers, different professional groups, policy makers, UN agencies, government and non government organizations, community groups and different countries. Networking and building partnerships will further bring benefits by enhancing research.

- Continuity and sustainability

This focuses on continuously maintaining acquired skills and knowledge. However, literature does not explore this concept well where it is important for post disaster waste management. Crisp *et al* (2000) suggest that capacity can be sustained by applying skills to practice. It further, can be enabled by providing opportunities to extend skills and experience which may be linked with a concept of career development.

- Investments in infrastructure

Fifth focuses on investing in infrastructure to enable smooth and effective management of waste. For example, issues related to inadequate funds for establishing recycle plants, obtaining necessary

technical know how etc, shall be addressed in relation to capacity building. Hence, information on calls for funding, fellowships and conferences is important for long term survival. Hurst (2003) argued that information flow varied between trust and experience.

- Research and development

Sixth focuses on developing research capacity in post disaster waste management that is useful for practice. This will add new knowledge and inventions close to practice enhancing effectiveness and efficiency of post disaster waste management. The notion 'close to practice' means that research is highly relevant to practice or policy concerns. This involves creating opportunities for research such as scholarships, funds etc.

- Communication and coordination

It focuses on avenues of enhancing communication and coordination capacities of post disaster waste management. This will address issues encountered among non government organizations and volunteer groups related to communication and coordination such as non existence of practical guides, transparency and accountability. This involves developing policies and strategic plans which are statutorily enforceable and creating information databases for easy reference, etc.

As discussed, the proposed approaches set out a tentative by which capacity building can be enhanced for post disaster waste management. However, it may be affected by such external factors as cultural, social, economical, political, legal and environmental. The proposed approaches provide a basis by which capacity building can be enhanced in post disaster waste management.

## 6 **Conclusion**

Literature and pilot interviews reveal that though government had ambitious plans and high expectations for speedy recovery in the post Asian Tsunami period, capacity gaps prevailing in various scales under various organizations and circumstances are significant factors limiting success of post disaster management in Sri Lanka. This is also visible in post disaster waste management as well. The government organizations involved in post disaster waste management are suffering from institutional capacity gaps such as poor communication, lack of coordination and lack of authority to function. From the viewpoint of non-governmental organizations, lack of coordination, security restrictions and policy issues have been identified as main areas of concern. In addition, priority should be given to recycling process to enhance entire capacity of relevant organizations, even though recycling incurs excessive cost. These established importance of capacity building of post disaster waste management processes through enhancing capacities of individual, organizational, institutional and community levels with skills development, information management and resource acquisition for

a sustainable system. Accordingly, this paper presents proposed approaches to enhance capacities for effective disaster waste management in Sri Lanka.

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